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Waterways Experiment Station

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The Surface Wave Dynamics Experiment (SWADE) - A Retrospective Look at the Wave Modeling Activities

by
R. E. Jensen

Approximately 4 years ago a group of internationally known researchers in meteorology, air-sea interactions, and wave theory met for the last of many preliminary meetings finalizing their respective tasks for the Surface Wave Dynamics Experiment (SWADE) to commence in October 1990 off the DelMarVa peninsula. Not since the Joint North Sea Wave Project (JONSWAP, Hasselmann et al. 1973) had there been a concentrated measurement program investigating the evolution of wave spectra in deep water. This experiment was timely because new and improved in situ measurement methods and advancement of remote sensing devices had come of age in the estimation of high-resolution directional spectra, providing the basis to support a new generation of spectral wave models under development (The WAMDI Group 1988).

Background

In 1988 the Office of Naval Research (ONR) brought forth an Accelerated Research Initiative to study *Sea Surface Wave Processes*. The central goal of this program was to enhance understanding of the physical and dynamic processes of surface wave phenomena. Two field experiments were envisioned, the Surface Wave Processes Program (Weller et al. 1991), and SWADE. In addition to ONR, other U.S. government agencies, such as NASA, NOAA, and the U.S. Army Corps of Engineers, Waterways Experiment Station, Coastal Engineering Research Center (CERC) contributed financially, as well as in the form of facilities and personnel to carry off the experiment.

The SWADE group (consisting of 50-75 active participants) summarized the goals of the experiment:

- To understand the dynamics of the evolution of the wave field in the open ocean.
- To determine the effect of waves on the air-sea transfers of momentum, heat, and mass.
- To explore the response of the upper mixed layer to atmospheric forcing.
- To investigate the effect of waves on the response of various airborne microwave systems including radar altimeters, scatterometers, and synthetic aperture radars.
- To improve numerical wave modeling.

To accomplish these goals, in situ measurement systems (buoys) as well as radar-equipped aircraft were used. For long-term (6-month deployment) measurements, three National Data Buoy Center 3-m discus buoys (Steele et al. 1992), and the centerpiece, the Brookhaven Spar Buoy, were used. The Spar contained a battery of meteorological as well as wave measurement devices atop its massive structure. These four locations augmented seven existing NDBC buoy sites, as well as four coastal meteorological stations. Additional buoys, the WAVESCAN, WHOI-buoy, and four Mini-Met (only meteorological

measurements) became part of the SWADE array. Selected time periods approximately 2 weeks in duration were chosen from October 1990 - March 1991, called Intensive Operation Periods (IOP's). During these times, the radar-equipped aircraft would fly over the SWADE domain (Figure 1) in pre-determined flight paths dictated by each principal investigator.

All equipment was functioning and ready for the first IOP early in November. Unfortunately a massive storm developed off the Southern Carolinas late in October. By the time it reached the SWADE area its winds were in excess of 25 m/s and significant wave heights of 8.0 m were not uncommon. The Spar buoy was sunk, two of the Mini-Met buoys were set adrift, and the WHOI and WAVESCAN buoys failed. Although a considerable loss, it did not deter the SWADE group. The spar was eventually replaced with another NDBC directional buoy and a SWATH (small waterplane area twin hull) ship, the *Frederick G. Creed*, containing an array of meteorological and oceanographic instruments similar to that lost off the spar.

The SWADE group identified several storm scenarios that were critical to the success of the project. These were:

- Cold air outbreaks depicting large wind shifts for directional relaxation examinations.
- Steady, offshore blowing winds, for fetch-limited growth studies.
- Long fetch from the northeast, depicting swell wave propagation. Cyclones developing from the south and moving northward over the SWADE area.

All of the above storm types were clearly defined, and well measured. In late February 1991, the Gulf Stream migrated uncharacteristically in a westward direction into the SWADE array. Of the four principal directional SWADE buoys, three measured an increase in sea temperatures of 10° in about 3 hr, a clear indication of the intruding Gulf Stream. On 5 March 1991 (during IOP-3), all radar-equipped aircraft flew over the Gulf Stream, including one flight carrying Airborne Expendable Current Profilers, and Bathythermographs. The very unique wave-current interaction situation that was revealed on that day will continue to be studied for years to come.

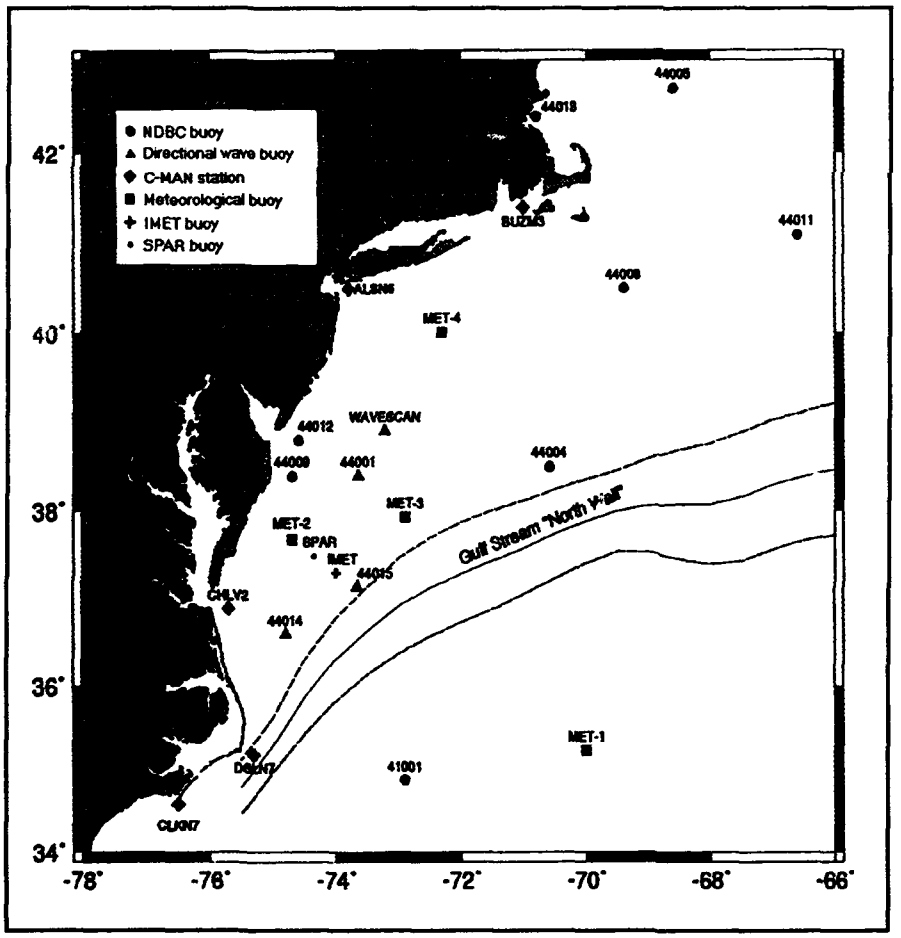

Figure 1. Geographic location of the SWADE buoys embedded in the network of existing NDBC stations. The mean (solid) and one standard deviation (dashed) positions of the* North Wall *of the Gulf Stream

Wave Modeling Activities

One of the many important facets of the SWADE project was in the area of wave modeling. CERC became an active participant in these activities. One unique spectral wave model was selected for this experiment, 3GWAM (The WAMDI Group 1988), to be run in a forecast mode (for aircraft planning purposes); a hindcast mode to study the interrelationships between the source/sink terms (atmospheric input, nonlinear wave-wave interactions, and dissipation); and an analysis tool to better replicate the energy balance with the measurements.

A 24-hr wave forecasting system was developed, tested, and implemented for the SWADE project. The Fleet Numerical Meteorology and Oceanography Center produced stress fields twice a day during the three IOP's. Those fields were accessed through the Civilian Navy/NOAA Oceanographic Data Distribution System and a high-speed modem. Once the wind fields were pre-processed and the wave model set up, the actual forecast would take place. All output files were post-processed in the form of wave height fields, with accompanying mean wave direction vectors (appropriately called Custer Diagrams), and also time plots of the mean wave parameters (significant wave height, peak wave period, mean wave direction), wind speed, and wind direction. Once completed, the files were shipped through the network to Wallops Island for the SWADE morning briefing.

At the conclusion of SWADE, the wave modelling team outlined a series of strategy papers, rigorously evaluating 3GWAM under various wind forcing functions, differing physics, shallow-water effects, and wave-current interaction tasks. A three-level gridded system was constructed for the SWADE project. The Basin scale grid covered the entire north and south Atlantic Ocean, from the coast of North and South America, eastward to Europe and Africa at a 1.0° longitude/latitude resolution. The second grid, called the Regional grid (0.25° resolution) covered the continental shelf area, from Nova Scotia to the Florida Keys. The finest scale grid, or the SWADE grid, extended from Cape Cod to Cape Hatteras extending approximately 400 km in the offshore direction (at 0.0833°). This grid nesting process worked quite well (Figure 2) where model simulations and grids were selected based on the processes (and scaling) to be studied.

In order to accomplish the first task, many forecasting centers around the world were sought to provide wind stress fields for the area:

- Fleet Numerical Meteorology and Oceanography Center (FNMOC)
- National Meteorological Center/National Weather Service (NMC/NWS)
- European Centre for Medium Range Weather Forecasts (ECMWF)
- United Kingdom Meteorological Office (UKMO)
- NASA/Goddard Space Flight Center[1]
- Oceanweather, Inc. (funded by Atmospheric Environment Service of Canada, OW/AES)[1]

Each forecasting center (FNMOC, ECMWF, UKMO) provided high quality wind fields that resulted in generally good quality wave estimates. Hindcast wind fields (NASA, OW/AES, and NMC/NWS, although the latter adopted the methods used in

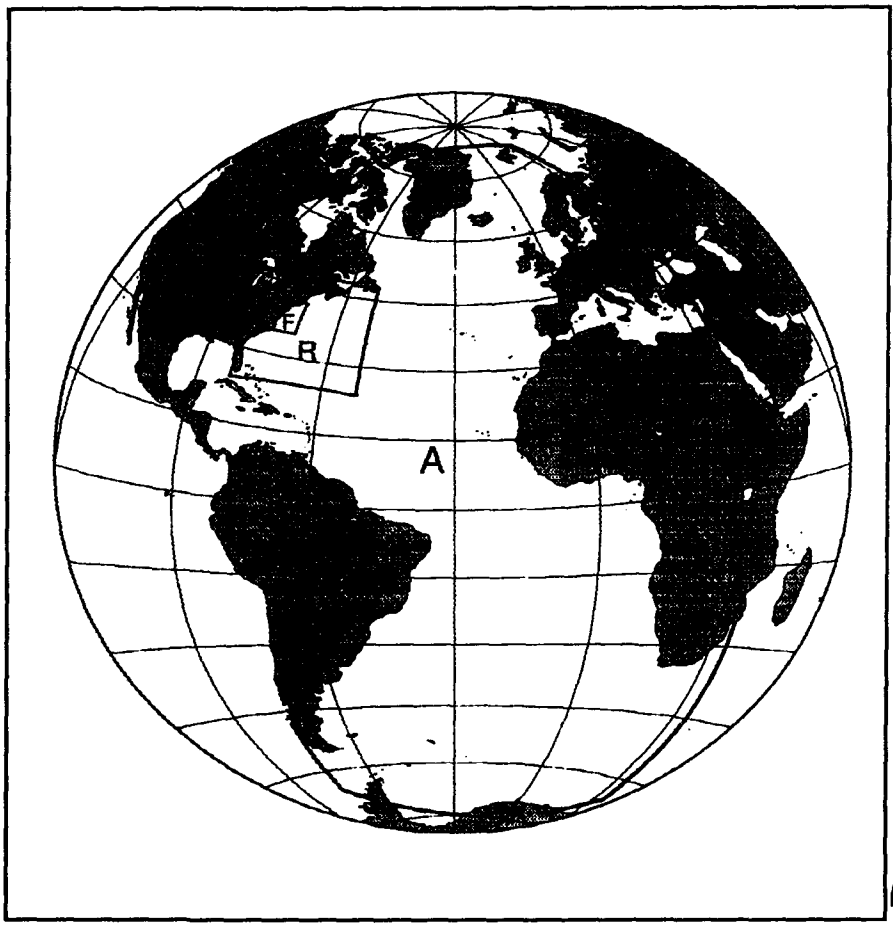

Figure 2. Hierarchy of grid nesting implemented for SWADE wave simulations (A = Basin Grid, R = Regional Grid, F = SWADE Grid)

[1] Wind fields provided for wave hindcast studies, and not part of an operational center.

SWADE for a new standard product) can rely on vast amounts of measured data that did not exist in the forecasting analysis mode. For example, the hand kinematic analysis method used to generate the OW/AES wind fields required over 600 man-hours to process. These wind fields were found to be of the highest quality, and produced unprecedented skill in the specification of all mean wave parameters (height, period, and direction) compared to buoy measurements in the SWADE region. This effort was not to show the inadequacies of forecast center wind field specifications. It did, however, provide the numerical wave modeler with the basis to distinguish wind field uncertainties from wave model deficiencies. Because of this type of effort, there are now excellent opportunities to test new wave model physics, perform trial energy balances, and identify spectral wave modelling deficiencies.

Work continues in the wave modelling team group. As many as 400 separate wave model simulations have been performed for the SWADE project, ranging from a few hours, where specification of the modelled source/sink terms have been evaluated, to a full 6-month hindcast of the SWADE time period.

Summary

After approximately 4 years and 20,000 directional spectra from various measurement platforms (e.g. Caruso et al. 1993; Caruso et al. 1994), SWADE can be considered a success. The data set derived from this 6-month deployment period (and two successful IOP's) has and will continue to provide the scientific community the basis to study the physical processes of ocean wave spectral evolution.

Being part of the SWADE experiment brought to CERC vast amounts of directional wave spectra data, insights and collaboration with an internationally recognized group of spectral wave theoreticians, and a first-hand introduction to state-of-the-art spectral modelling technology. CERC also strengthened its working relationships with other sections of U.S. governmental services, such as the Navy, NASA, and NOAA by sharing data, machine-made wind and wave fields, and insights into spectral wave modelling that continue to this day.

References

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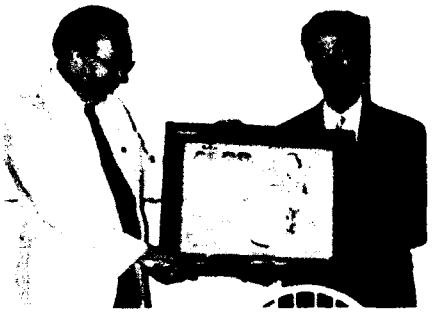
Dr. Robert E. Jensen is a Research Hydraulic Engineer at the U.S. Army Engineer Waterways Experiment Station's Coastal Engineering Research Center (CERC). He received a Bachelors degree in Atmospheric and Oceanographic Sciences, a Bachelors of Engineering degree in Environmental Sciences Engineering at the University of Michigan, and a Masters degree in Ocean Engineering at Oregon State University. He received his Ph.D. from Texas A&M University in 1983. Since that time, he has been at CERC working on the Wave Information Study and, more recently, heading research and development efforts on spectral wave modeling and surface wave dynamics.

John Housley Retires

Mr. John G. Housley recently retired from the Directorate of Civil Works in Corps Headquarters. A World War II Navy veteran, he obtained his B.S. degree in Civil Engineering from Lehigh University, then came to work for the Corps of Engineers at WES in 1951 where he worked for Mr. Robert Y. Hudson in the Hydraulics Laboratory. While at WES, he earned his M.S. in Civil Engineering at MIT. He later transferred to the Lake Survey District and, in 1970, transferred to Corps Headquarters. He had long-time involvement with the Coastal Engineering Research Board (CERB), attending CERB meetings from 1964 to 1993, and acted as an assistant to the Director of Civil Works on matters pertaining to the CERB. He has a major role in the Section 54 Low-Cost Shore Protection Program and, among his many duties, served on the ACES Pilot Committee and as a technical monitor for the Corps' coastal R&D programs.



In the photo, John (on the left) is seen during his last official visit to CERC, receiving a memento from Dr. James R. Houston, Director of CERC.

Beachfill Costs on Target

The U.S. Army Corps of Engineers is in the process of conducting a study to evaluate the economic and environmental effectiveness of the Federally sponsored Shore Protection and Beach Erosion Control Program. The study is being conducted in response to a request by the Office of Management and Budget. The study reviews the period from 1950 to 1993. There were 56 large projects, covering 210 miles of coastline, for which the Federal government provided $403.2 million from 1950 to 1993. The Federal share was 60 percent of the total project costs.

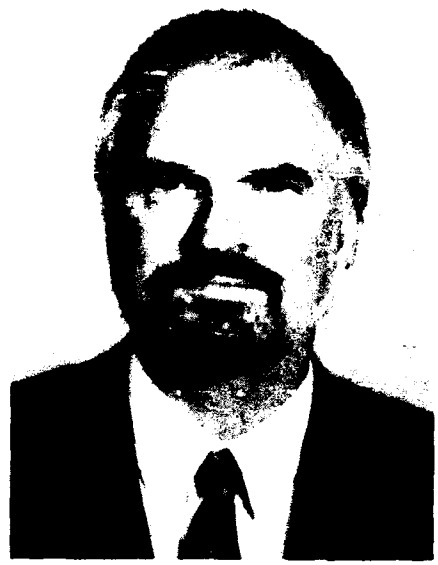
As part of the Phase I effort of the study, comparisons of estimated costs and actual costs were made for beach restoration on 40 projects, beach nourishment on 33 projects, and structures on 35 projects. Costs were adjusted to 1993 dollars for comparison purposes. The study shows that actual costs were 96 percent of original estimated costs. An additional comparison was made of sand volume placed. The ratio of volume placed, from 1950 to 1993, to original estimated volume required was 1.05.

Coastal Dynamics '95

Coastal Dynamics '95, an international conference on coastal research in terms of large-scale experiments, will be held in Gdansk, Poland, on September 4-9, 1995. The conference will focus on recent technical and scientific progress in coastal dynamics resulting from data collected in large laboratory facilities or in the field. Conference topics will encompass the following areas of coastal research: hydrodynamics and related physical oceanography of coastal areas; sediment transport dynamics; morphodynamics and shore evolution; water quality; and remote sensing and other large-scale monitoring techniques. English will be the official language of the conference. Authors are invited to submit by mail three copies of an abstract by January 15, 1995. The total length of the abstract should not exceed two pages, including figures. Point of contact is Polish Academy of Sciences, Institute of Hydro-Engineering, IBW PAN, 7 Koscierska, Gdansk 80-953, Poland, Email cdsec@hapcio.ibwpan.gda.pl, FAX (+4858) 524211.

New Senior Research Scientist

Dr. Donald T. Resio became a Senior Scientist (ST) at the U.S. Army Engineer Waterways Experiment Station's (WES) Coastal Engineering Research Center (CERC) on 16 May 1994, in recognition of his career achievements in the research area of coastal wave dynamics and coastal sedimentation. As a Senior Scientist at CERC, Dr. Resio performs a range of research related to military activities such as Logistics Over the Shore (LOTS) and to the solution of civil problems such as coastal erosion, maintenance of navigation channels, and disposal of dredged material. Dr. Resio also serves as the CERC advisor to other scientists and engineers in their research and related applications. Immediately prior to accepting his ST position, Dr. Resio served as an associate professor of Oceanography at the Florida Institute of Technology in Melbourne, FL. Dr. Resio's prior experience includes the following: President of Offshore and Coastal Technology (OCTI), Vice-President of Oceanweather, and Research Physical Scientist at WES.



Dr. Resio's education includes a BA degree in Physical Geography, an MS degree in Environmental/Physics Science from the University of Virginia, and a Ph.D. from the University of Virginia in Environmental Science.

His awards and recognitions include the Army Research and Development Award in 1980, his selection to the Wave Statistics Committee of the American Society of Civil Engineers, and his selection to be an expert witness in several large court cases of international significance. Dr. Resio also has served as the chief oceanographic advisor to numerous private companies and government agencies worldwide and was recently chosen to be the invited lecturer to provide wave prediction training to professors and engineering professionals in Australia.

Postdoctorates in Climate Change

The National Oceanic and Atmospheric Administration's (NOAA) 1995 Postdoctoral Program in Climate and Global Change has recently been announced. The program offers up to a 2-year visiting research appointment, reviewed annually. Applications are solicited from postdoctoral candidates, and host scientists are invited to submit letters of intent to help the committee in the matchmaking process. A steering committee, representing the skills and interest covered by this program, selects the fellows and assists in coordinating appointments with agencies and institutions.

There is no application form. Qualified scientists are encouraged to apply by sending the following information: Ph.D. dissertation abstract, including title of the dissertation; proposed project description; statement of proposed project relevance to climate and global change; resumé with list of publications; names and addresses of four references, one of whom must be the dissertation advisor. If applicants do not know in advance with whom or where they prefer to study, the committee will attempt to match applicants and institutions.

Scientists interested in being hosts are encouraged to send a short letter briefly stating their interest and, if so inclined, describing the type of background they would prefer to see in their postdoctoral fellow. Hosts are expected to mentor the fellow as well as provide a workstation and cover any other unique research costs associated with this fellowship. A limited amount of scientific travel funding is available.

Application materials must be submitted no later than 1 March 1995 to Meg Austin, Program Manager, UCAR Office of Programs, P.O. Box 3000, Boulder, CO 80307 For further information contact the UCAR Office of Programs at 303-497-8649 or E-mail at bappelha@ncar.ucar.edu.

CEEP Graduation

The second class of the Coastal Engineering Education Program (CEEP) graduated on 16 August 1994 at the Waterways Experiment Station's (WES) Coastal Engineering Research Center (CERC). Diplomas were presented to Peter Grace, Jacksonville District; Tom Smith, Jacksonville District; Tony Risko, Los Angeles District; and Linda Lillycrop, CERC. The CEEP is a 1-year program administered jointly by the WES Graduate Institute and Texas A&M University (TAMU). The students completed 15 semester hours at TAMU; 3 semester hours at CERC's Field Research Facility in Duck, NC; and 19 semester hours at WES, for a total of 37 hours. Students completing degree requirements will also receive a Master of Engineering degree from TAMU.

The CEEP is offered every third year, with the next class scheduled for the 1996-97 academic year. Interested Corps of Engineers employees should submit applications during the 1994 long-term training survey. The program is not limited to Corps employees. Information on the program is available from Dr. Jim Pennington, director, WES Graduate Institute at (601) 634-3549 or Charles C. Calhoun, Jr., Assistant Director, CERC at (601) 634-2001.

Barrier Island Ocean Watch Network

The Alliance for a Living Ocean, an ocean conservation organization located in Beach Haven, New Jersey, has established a barrier island ocean watch network (BIOWNET) to connect U.S. barrier island communities. The network's goal is to exchange ideas dealing with dune protection and replenishment, beach cleanups, protection of seashore habitats, ocean conservation, and other related topics. Information can be obtained from Mr. Fred Bach via E-mail at fbach@igc.apc.org.

Science and Engineering Apprentice Program

As part of the Science and Engineering Apprentice Program, CERC hosted five students this summer. The program, administered through George Washington University, allows high school students to work under the mentorship of a CERC scientist or engineer for 8 weeks during the summer. The students conduct research on a particular project and at the end of the summer write a paper about their work. They then present their paper at George Washington University with approximately 600 other participants in the program. The projects for CERC students this summer included: "Database for Selecting Optimum Logistics-Over-the-Shore Sites in Central America" by Jessica Lin, "The Core-Loc Concrete Armor Unit Versus the Dolos Concrete Armor Unit" by Thomas Baggett, "Geographic Information System (GIS) and the Coastal Engineering Research Center" by Eric Payne, "Coastal Inlet Database and Classification System" by Christian Hancock, and "Evaluation of Water Clarity Data for Airborne Laser Bathymetric Surveying" by Wesley McCleese.

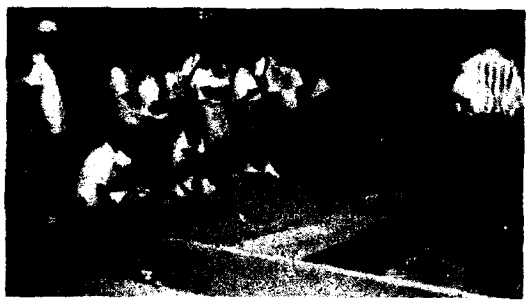
Young Scholars Program

Forty-two high school students were selected to participate in the 1994 National Science Foundation Young Scholars Program on coastal erosion and preservation at McNeese State University, Lake Charles, Louisiana. Students were chosen on the basis of grades, an essay, their awards and accomplishments in high school, and letters of recommendation from science and math teachers. The students were divided into two groups for the program.

Each group of Young Scholars spent 3 weeks studying coastal engineering and shoreline preservation. During the second week they spent 3 days at the U.S. Army Engineer Waterways Experiment Station's Coastal Engineering Research Center (CERC), where they attended lectures and demonstrations of laboratory and numerical models by CERC engineers and scientists. The students also collected wave data in a laboratory flume and performed PC data analysis.

As part of the program, each student designed a model of a device to prevent coastal erosion and tested the model in a wave flume. Holly Beach and Constance Beach, Louisiana, on the Gulf of Mexico, served as an outdoor laboratory. Students observed attempts at coastal preservation, and measured the rate of erosion by surveying the beach line.

An award was given to the top Young Scholar in each session. Additional information on the program may be obtained from Mary Richardson, Project Director, McNeese State University at (318) 475-5123.









COASTAL 95

An international conference, Coastal '95 - Computer Modelling of Seas and Coastal Regions, will be held in Cancun, Mexico, on September 6-8, 1995. The conference is being organized by the Wessex Institute of Technology, Southampton, UK, and the Universidad Autonoma Metropolitana, Iztapalapa, Mexico. The conference will emphasize computer modelling of seas and coastal regions under normal and extreme conditions, with special interest on practical applications currently being carried out around the world. The conference will be held at the Sheraton Cancun Resort and Towers. Three copies of an abstract not exceeding 300 words should be submitted not later than November 4, 1994, for review. Enquiries should be addressed to Liz Johnstone, COASTAL 95, Wessex Institute of Technology, Conference Secretariat, Ashurst Lodge, Ashurst, Southampton, SO40 7AA, United Kingdom, FAX 44 (0) 703-292853, E-mail cmi@ib.rl.ac.uk.

Publications of Interest

The following publications are available from the sources indicated. They are not available from CERC.

The Evolving Coast, 231 pages, Scientific American Library, price not listed. Copies available from W. H. Freeman and Company, 41 Madison Ave., New York, NY 10010.

Submerging Coasts: The Effects of a Rising Sea Level on Coastal Environments, 184 pages, softcover, $64.95; *The Economics of Coastal Management: A Manual of Benefit Assessment Techniques* (Includes five case studies from the United Kingdom), 1992, 368 pages, $99; and *Basic Wave Mechanics for Coastal and Ocean Engineers*, 285 pages, $64.95. Copies available from John Wiley & Sons, 1 Wiley Drive, Somerset, NJ 08875. By Telephone 1-800-225-5945, 0830-1730 Eastern Time Zone (Monday thru Friday).

Coastal Stabilization, Innovative Concepts, 578 pages, $96. Copies available from PTR Prentice Hall, Inc., Englewood Cliffs, NJ.

Geotimes, monthly publication, $24.95 per year ($38.95 per year outside the United States). Subscriptions available from the American Geological Institute, Geotimes, 4220 King Street, Alexandria, VA 22302-1507. By telephone (703) 379-2480.

Hurricane Hugo: Puerto Rico, the Virgin Islands, and Charleston, South Carolina, September 17-22, 1989, 1994, 296 pages, $39 plus $4 shipping and handling, prepaid. Copies available from the National Academy Press, 2101 Constitution Avenue, NW, Box 285, Washington, DC 20055. By telephone (202) 334-3313.

Lessons Learned from Hurricane Andrew, 1993, 137 pages, Stock No. 552-070-14741-1, $5. Transcript of Hearings by the Senate Committee on Environment and Public Works. Copies available from the Superintendent of Documents, U.S. Government Printing Office, Congressional Sales Office, Washington, DC 20402-9315. By telephone (202) 512-2470.

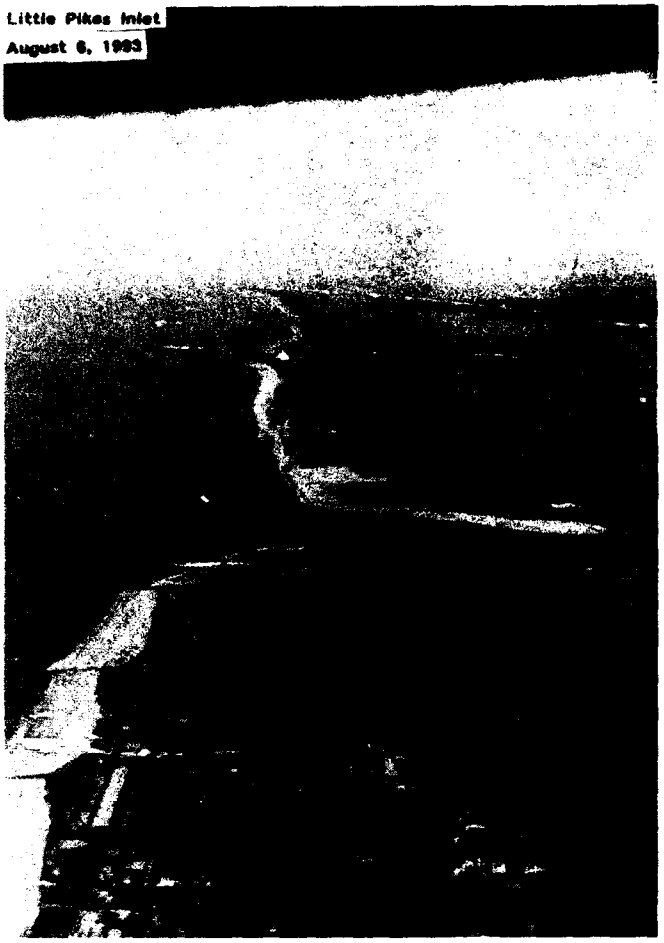
Tsunamis Affecting the West Coast of the United States, 1806-1992, 1993, 242 pages, softcover, $15, prepayment required, MasterCard, Visa, and American Express accepted. Copies available from National Geophysical Data Center, E/GC4, Dept 942, 325 Broadway, Boulder, CO 80303-3328. By telephone (303) 497-6277, FAX (303) 497-6513, e-mail: info@mail.ngdc.noaa.gov.

Tsunamis on the Pacific Coast of Washington State and Adjacent Areas - An annotated Bibliography and Directory, 1994, 18 pages, free. Copies available from Connie J. Manson, Washington Division of Geology and Earth Resources, 1111 Washington Street SE, Room 173, P.O. Box 47007, Olympia, WA 98504-7007. By telephone (206) 902-1472, FAX (206) 902-1785, e-mail: cjmanson @u.washington.edu

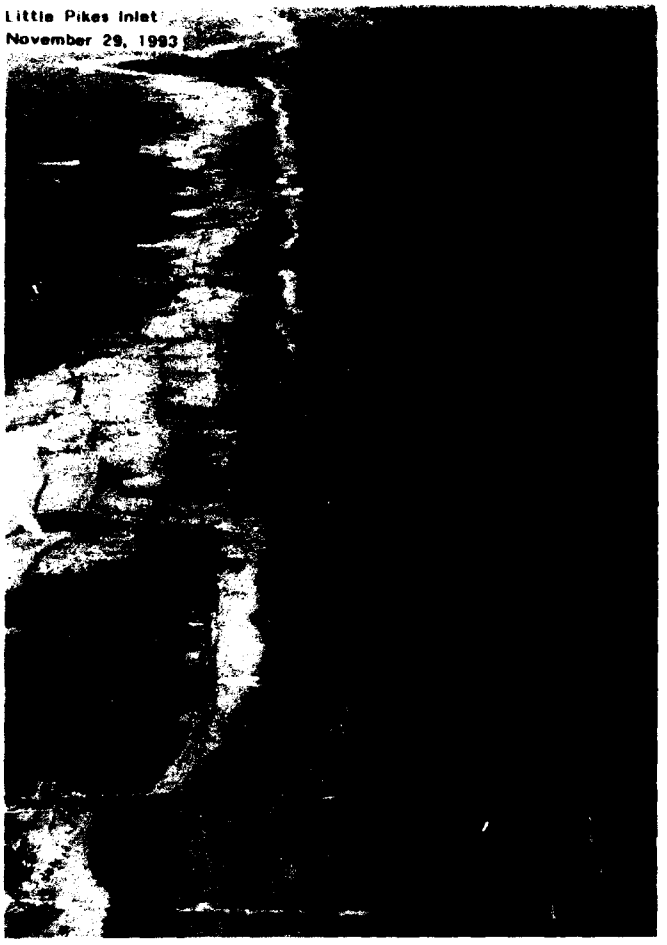
IAPSO Change of Venue

Due to logistical problems encountered at the originally scheduled site, the International Association for the Physical Sciences of the Oceans (IAPSO) has changed the venue for its XXI General Assembly from Boulder, Colorado, to Honolulu, Hawaii. The scheduled dates have changed and are now August 5-12, 1995. Point of contact for information on the symposia schedule and registration is Dr. Robert E. Stevenson, Secretary-General, IAPSO, FAX (619) 481-6938, E-mail: r.stevenson.iapso@omnet.com, or iapso@electriciti.com.

Little Pikes Inlet, Breach and Closure



Little Pikes Inlet - breach in the Westhampton barrier island on the south shore of Long Island, New York. The area was impacted by a series of storms occurring in late 1992 and early 1993, with the initial breach forming during the December 1992 Nor'easter. The growth rate of the breach was 116 ft/day measured at Dune Road from February to March 1993, eventually stabilizing at a 5,000-ft width in March to April 1993. The throat of the inlet increased at a maximum rate of 24 ft/day, eventually reaching a maximum width of 2,000 ft by August 1993 (Photo by Dan Covello, First Coastal Corp., used with permission).



Inlet Closure - Little Pikes Inlet was closed starting in August 1993, using 1.5 million yd^3 of sand from an offshore borrow site and 1,800 linear ft of 30-ft steel sheet piling. Initial construction of the closure was from east to west in the direction of the predominant longshore sand movement. An abrupt change in the direction of sand movement during the final stages of construction resulted in immediate closure of the breach, and final sand fill was placed on the west shore proceeding east (Photo by Dan Covello, First Coastal Corp., used with permission).

Calendar of Coastal Events of Interest

Nov 8 - 10, 1994	Coastal Engineering Research Board Public Meeting, Vicksburg, Mississippi POC: Sharon Hanks (601) 634-2004, FAX (601) 634-4253, Internet: SHARON@COAFS1.WES.ARMY.MIL
Nov 13 - 16, 1994	Dredging '94, Buena Vista Palace Hotel, Lake Buena Vista, Florida POC: Charles Calhoun (601) 634-2001
Jan 9 - 13, 1994	Dredging Engineering Short Course, Texas A&M University, College Station, Texas
Jan 25 - 27, 1995	New Strategies for America's Beaches, St. Petersburg, Florida POC: David Tait (904) 222-2677, FAX (904) 561-1172
Feb 3 - 5, 1995	CoastGIS '95, Cork, Ireland, FAX 353-21-271980
Apr 3 - 7, 1995	Corps of Engineers National Interagency Workshop on Wetlands, Clarion Hotel, New Orleans, Louisiana, POC: (601) 634-2569/4217, FAX (601) 634-3664
May 1 - 4, 1995	Offshore Technology Conference, Houston, Texas, POC: FAX (214) 952-9435
May 24, 1995	Annual Dredging Seminar, Minneapolis, Minnesota
May 25 - 26, 1995	Western Dredging Association, Annual Meeting, Minneapolis, Minnesota
Jul 17 - 22, 1995	Coastal Zone '95, Tampa, Florida, POC: Dr. Billy Edge, (409) 847-8712 FAX (409) 845-6156
Aug 5 - 12, 1995	International Association for the Physical Sciences of the Oceans, XXI General Assembly, Honolulu, Hawaii
Sep 4 - 9, 1995	Coastal Dynamics '95, Gdansk, Poland, email: cdsec@hapcio.ibwpan.gda.pl FAX: (+4858) 524211
Sep 6 - 8, 1995	Coastal '95, Cancun, Mexico, email: cmi@ib.rl.ac.uk
Nov 14 - 17, 1995	14th World Dredging Congress, Amsterdam, The Netherlands

Risk Analysis Net

Battelle Pacific Northwest Laboratory and the Columbia-Cascades Chapter of the Society for Risk Analysis have established a Risk Analysis mailing list on Internet. Subscribers to the mailing list, RISKANAL, will receive any messages sent to the list either periodically in digested form or immediately upon receipt, and can choose which form of the list they want to receive. The mailing list is moderated (i.e., immoderate or inappropriate postings are filtered out) to reduce e-mail "noise" and to better comply with the list's goals.

For purposes of the list, risk analysis is broadly defined and includes all forms of natural hazards. Appropriate postings include news items of interest, conference announcements, information requests and responses, job announcements, and information on software. Information can be obtained by e-mail from js_dukelow@pnl.gov. To subscribe, send the e-mail message: subscribe riskanal <first name> <last name> to listserv@voglnp.pnl.gov. Messages to the list should be sent to riskanal@voglnp.pnl.gov.

Changes of Address

We receive numerous inquiries from people who find they are no longer receiving the CERCular. This is usually because they have moved without sending in a change of address. A central office at the U.S. Army Engineer Waterways Experiment Station maintains distribution lists for all six laboratories at WES. Recipients of publications are given individual identification numbers which appear on the mailing labels. The code on the mailing label has the form <identification number>/<distribution list number>/ <number of copies to your address - usually one>. As an example, a mailing code on a label reading 99999/L23/1 means that your personal identification number is 99999, the material being mailed is the CERCular (List number 23), and you are receiving one copy (the standard mailing). A single notice of change of address will suffice for all publications received from WES. A standard postal change of address card should be sent to:

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ATTN: CEWES-IM-MV/Angie Giles
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Vicksburg, MS 39180-6199

Change of address cards are available at any U.S. Post Office. Please include your old mailing address, with identification number, and your new mailing address.

Potts Point, South Harpswell, ME, August 1994, view looking southeast. This is one of the long, north-south trending islands that project into Casco Bay. The rocky outcrops are weathered, friable metamorphic schists and gneisses. There are some intertidal marshes in this region located on peat deposits, but very little sand is present along the shore. *Photo courtesy of Any Morang, CERC.*

The CERCular

Coastal Engineering Research Center

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ROBERT W. WHALIN, PhD, PE
Director

DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199

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